Bioeconomy and Production Development

IICA

Policy brief

Bioeconomy in the coffee value chain: an opportunity to be seized

The bioeconomy model: an urgent priority

Nowadays, the world faces a pressing need to find alternatives to the prevailing fossil fuel-intensive models. Thus, development strategies based on greater and more efficient use of biological resources, technologies and processes for the sustainable provision of the goods and services that our societies require present a unique opportunity.

Today's challenges are environmental, economic and social, calling for innovative solutions that yield greater economic returns, while taking greater care of the environment and opening up new opportunities for employment and development in rural areas, which are home to the greatest concentration of poverty and marginalization in the region.

The bioeconomy offers solutions. The use of biomass in different value chains provides an opportunity to boost the productivity of biological resources and to capitalize on new developments in sciences, technology and expertise to utilize and transform previously unexploited resources into high value-added products or services. Greater exploitation of biological elements is critical, considering that the global market is becoming substantially larger, wealthier and older. Consequently, agricultural production will have to practically double,

What is the bioeconomy?

The bioeconomy is the intensive and knowledge-based use of biological resources, processes, technologies, and principles, for the sustainable provision of goods and services in all sectors of the economy (IICA 2018).

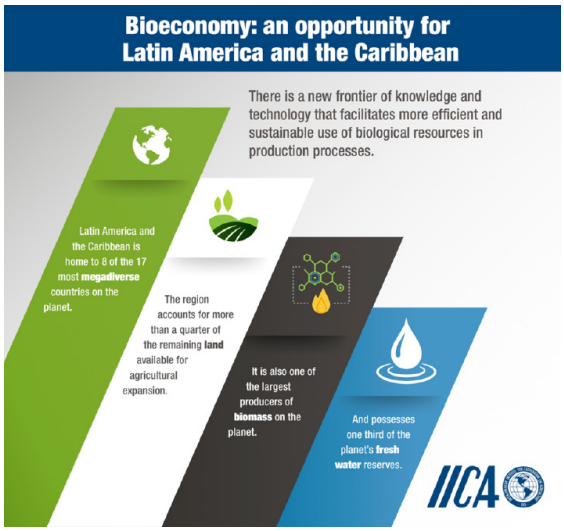
notwithstanding the decrease in available land, growing restrictions in the per capita cultivated land (25% less), fewer available water resources (water demand will increase by 50%), diminishing biodiversity and natural resources and the ensuing increase in climate change repercussions.

In this context, the bioeconomy proposes a broader and more ambitious vision of development that is increasingly relevant for the achievement of the Sustainable Development Goals (SDGs) and for the implementation of strategies to decarbonize the economy, which will be critical to meeting greenhouse gas (GHG) emission objectives to maintain the average global increase in the temperature to below 2 °C by the end of this century.

Coffee: a powerful economic driver for Latin America and the Caribbean

The region's biological wealth positions it to play a leading role, particularly in a world in which the impacts of climate change and the degradation of natural resources are progressively severe. The Latin American and Caribbean (LAC) region is the major global producer of sustainable biomass and is also equipped with the necessary scientific-technological expertise, industrial infrastructure and entrepreneurial base to mobilize that potential, which it is already doing in numerous sectors (IICA *et al.* 2019).

ALC is called upon to play a leading role in a new development model that will seek to create a balance between the environmental, food and energy demands in the upcoming years. New advances in sciences and technology offer the region the possibility to better capitalize on its tremendous biological wealth.



On the other hand, coffee is one of the engines of the rural economy in LAC and one of the main sources of employment and income. Currently, more than 14 million people are involved in coffee-related activities in Central America, Colombia, Bolivia, Brazil, Ecuador, Jamaica, Panama, Peru, Mexico and the Dominican Republic. The combined production of coffee in Central America, Jamaica, Panama, Peru, Mexico and the Dominican Republic is more than 30 million bags (of 46 kg each), representing approximately 25 % of the total production of Arabica coffee in the world. In countries such as Honduras and Colombia, coffee accounts for more than one third of total exports from the country.

A crisis that can be transformed into an opportunity

Low international prices and the onslaught of pests and diseases endanger the income of coffee producers, increasing their risk of debt. With a lower cash flow, investments destined for agriculture also decline. Consequently, previously controlled pests and diseases, such as coffee leaf rust, reemerge with greater virulence. The greatest devastation caused by this scourge occurred during the 2012-2013 period. Production in Central America and the Caribbean was severely affected with the loss of approximately 2.7 million bags (close to 20% of total production).

Although the LAC coffee industry has been recovering in a slow albeit sustained manner, lower prices having heightened the urgency of ensuring the economic sustainability of the activity, by making strategic investments in farms to keep production costs at a minimal or optimal level, and seeking to sustain levels of employability, despite minimal levels of productivity and use of technology. Indeed, the current situation impacts employment and income, prompting daily migration, particularly of young people, who are gradually abandoning rural areas.

The value of global coffee exports is about USD 20 billion, with the total value generated by the industry amounting to approximately USD 200 billion (Panhuysen and Pierrot 2018).

Given this scenario, it seems unavoidable to wonder if all the biological potential of coffee plantations has been exploited. Although it may seem contradictory, the current crisis offers an opportunity to expand beyond mere coffee production, seeking new opportunities to add value, diversify income and generate wealth.

The bioeconomy allows to capitalize on new scientific and technological expertise to improve productivity and the sustainability of biological resources, while generating new and high value-added bioproducts and bioservices.

Less than 5% of the biomass that is generated throughout the entire coffee production chain is used to prepare the beverage. The remainder is lignocellulose (leaves, branches and stems obtained during coffee tree renovation); green fruit that falls to the ground during harvesting; fruit removed from the lot during processing; and other residue, including the pulp, mucilage[1], parchment (hull or endocarp) and the grounds[2] or dregs that remain after preparing the beverage. This provides at least two major opportunities: one the one hand, to use the products of the plant more efficiently, and on the other hand, given that the new biology provides us with a better understanding of how the plant functions, to consider enhancing its production capacity (improving the quality, building resistance to pests, etc.) It would not be amiss to also mention the role of research and development (R+D), in general, and biotechnology, specifically, in meeting these goals.

1. Viscose plant substance that adheres to the parchment of the coffee by natural enzymes, composed mainly of water, sugars and pectic substances and containing mainly yeasts.
2. The residue of the ground coffee after coming into contact with hot water.

The bioeconomy and the challenges of the coffee chain

Challenge	Solution offered by the bioeconomy
Decline in productivity (low yields and problems with pests and diseases)	✓ Improved materials: better yields, resistance to water stress, pests and diseases. ✓ Greater business efficiency and sustainability. ✓ Diversified production. ✓ Lower costs, less vulnerability. ✓ Use of the entire product – providing sustainability to all areas within the coffee chain.
Low prices in international markets	✓ Value adding and differentiation, thereby enabling differential pricing and better market growth prospects. ✓ The use of byproducts that were previously considered to be waste creates new, productive and profitable options.
Extensive amount of waste and residue that negatively affects the environment	✓ Generation of bioenergy and bioproducts for the food, cosmetic, chemical and other industries, using waste, which in most cases, was a source of pollution. ✓ Generation of lower volumes of non-usable waste. ✓ Lower volumes of transported products. ✓ Substitution of chemical inputs for use in farming operations (bioinputs).
Unemployment and migration in coffee regions	✓ Generation of new job opportunities in rural areas in the new chains. ✓ Generation of job opportunities outside of harvest season. ✓ Greater impact on the rural economy.

Success stories prove that it is possible!

Brazil

AQIA Coffee (http://aqia.net/en/aqia-coffee/), a business established in 2015 by the Guaxupé Regional Cooperative of Coffee Producers (Cooxupé), and AQIA Química Industrial, launched a line of cosmetics that are manufactured with components derived from oils and pulp from green coffee beans.

This is the first coffee cooperative in Brazil that is extracting raw material for new niche markets. The AQIA coffee line includes green coffee oil (viscous liquid), coffee oil (liquid), coffee butter (semi-solid and solid butter), slim green coffee (uniform powder, Cherry Coffee Oil (viscous liquid), Cherry Coffee MCT (liquid) and Nutri Coffee (micronized powder). The latter gave rise to the development of the Chococoffee prototype, in which cocoa powder is replaced with powdered coffee. The aim is for these areas to generate commercial growth of between 20% and 50% for AQIA, by 2020.

The project invested between USD 1.2 million and 1.7 million in research and in establishing a factory in Guaxupé (Minas Gerais) to begin the process of extracting green coffee oil for the cosmetic industry. In addition to the oil, the residue remaining after the extraction of the raw material (pulp) is used for exfoliating products. The idea is to venture outside of the Brazilian market and to export the AQIA coffee line to Latin America, the United States and Europe, aiming for USD 2.5 million growth within five years. The current portfolio of the company includes brands such as Natura, Unilever, P&G, J&J, Avon, Boticario, Embelleze, Colgate, Stiefel and Aché.

Colombia

Colombia is the leading developer of products derived from coffee. One of the most outstanding examples is Sanadores Ambientales, (http://sanam.company/es/), a company that uses mucilage to produce honey and coffee hull to produce flour. Both products are used for human consumption, as well as for livestock feed, the cosmetic and pharmaceutical

industries. The waste is also used to produce ethanol.

Another Colombian company, Natucafé (http://natucafe.co/), processes mucilage to produce coffee cherry extract. At first, this product was for animal consumption and for ethanol production but having discovered its high antioxidant content, the company began to use it as a raw material in the manufacture of functional beverages: +Vital and +Vital Plus.

Costa Rica

Coopetarrazú (https://www.coopetarrazu.com/), a cooperative that boasts a history of more than 57 years and with membership of more than 4,650 associates, has succeeded in technifying pulp composting. It does so by introducing organic material into the soils of coffee plantations to prepare substrate that is suitable for the establishment of microorganisms that are applied by way of bioinputs. The cooperative also uses densified pulp for fuel for drying or electricity generation, to manufacture flour for human or animal consumption and for tea production. The mucilage is used in antioxidant energy drinks for human consumption.

Honduras

Los Catadores farm (https://exoticoscafe.com/index.php/finca-los-catadores/) has undertaken a variety of experiments that have led to the development of innovative products, including infusions using coffee leaves and pulp. The results reveal that dried pulp is purer and more versatile than the hull that is obtained through natural processes, and the dried pulp can be used to produce an array of exotic beverages, with notes of vanilla, raisins, chocolates and almonds, depending on the type of coffee.

México

Students of the Veracruz campus of the Tecnológico de Monterrey developed a bioplastic for the textile and shoe industry. The material is obtained by extracting the pulp from coffee. The project was named Biobex and was born with the aim of providing financial assistance to producers and reducing the environmental impact caused by decomposed waste.

Recommendations: what can we do to maximize use of the benefits of the bioeconomy in the coffee value chain?

The opportunities are there, waiting to be transformed into concrete businesses, through the innovation, creativity, drive and leadership of those who know how to adopt a multidimensional and integrated approached that allows them to capitalize on technology and processes outside of the agricultural sphere. However, securing the commitment of a wide range of public and private sector actors and developing a public policy environment that enables, support and strengthens the development of these businesses is also indispensable.

In promoting the bioeconomy in the coffee value chain, national and strategic plans should also focus on five areas of work:

1. Awareness-raising on the potential of the bioeconomy in the coffee value chain

- ✓ Generate documentation to disseminate the concept of the bioeconomy, as it relates to exploiting opportunities in the coffee value chain, showing examples and providing recommendations (such as this policy brief).

- ✓ Mapping all the key actors in the coffee value chain with a strategic interest in taking advantage of these opportunities.

- ✓ Work with public and private actors in the country's coffee value chain, in particular, coffee producer organizations, to:

    - Thoroughly research the biological resource, its characteristics and possible ways to better exploit it, identifying the financial and environmental potential benefits.

    - Identify, analyze and disseminate lessons learned with respect to the coffee value chain and determine how to utilize this knowledge to trigger similar processes in other countries and territories.

    - Identify best practices in the area of sustainability, production and processing to work with standards and qualities that exceed the basic requirements in the new applications of the bioeconomy in the coffee value chain.

- ✓ At the government level, develop a long-term vision and adopt a commitment at the highest level to foster the use of the bioeconomy in national strategies related to coffee and in institutional advocacy policies.

- ✓ Facilitate and create pilot and demonstration plans that enable the publicizing and scaling up—having identified lessons learned—of processes involving the use of the bioeconomy in the coffee value chain, and which are profitable and impact the different coffee cultivation-related business sectors.

2. Investments and financing for the value chain

- ✓ Develop public-private partnerships to secure investments and financial support for the development of businesses working with coffee byproducts.

- ✓ Reduce taxes and promote financial incentives, subsidies, lower interest rates, longer depreciation grace periods and other guarantees for businesses based on the application of the bioeconomy in the coffee value chain.

- ✓ Attract private investors (venture capital or corporate investments).

- ✓ Develop support services to increase the availability of capital and financial

instruments, and which offer incentives to support new markets.

3. Innovation and technology for new uses

- ✓ Greater investment in R+D to be able to effectively translate new knowledge into results—technologies, new processes, applications and products—that are direct and accessible to all actors in the coffee system.
- ✓ Promote learning and action communities focusing on innovation and technologies that can add value to coffee producers.
- ✓ Provide opportunities for public-private exchange with relevant actors in the coffee chain to share and manage knowledge on this issue.

4. Foster bioproduct markets (demand)

- ✓ Define and promote purchasing and public procurement mechanisms for products development under the bioeconomy concept.
- ✓ Develop standards, regulatory guides and standardization processes for the marketing of new biologically based products and processes.
- ✓ With the backing of the Government, create an important instrument to drive demand, which establishes selective and preferential mechanisms for the purchasing of bioeconomy-based products.

5. Capacities of the value chain actors

- ✓ The successful shift towards better uses of the bioeconomy in the coffee value chain will require intensive human resource development. Bio-based processes require not only a new technological base, and consequently, a restructuring of the scientific skills base for R+D, but will also need producers to be equipped to manage the new processes, which will undoubtedly be more knowledge-intensive.
- ✓ At a more aggregate level, biobased strategies also alter the established equilibrium of a given society (local, regional, national and international), in terms of patterns of accessing and use of resources, distribution of benefits and many other aspects of the existing status quo. These changes create the need to train communities in new ways of operating, and to establish very clear decision-making processes to identify the advantages and disadvantages of working with a new system, understanding the different levels of application and differences involved in working with short and long-term expectations. In this way, training at all levels, from primary education forward, including extension programs, promotion of business capacities and social communication and decision-making processes, are key strategies to maximize the use of the bioeconomy.

IICA technical cooperation in this area

The Inter-American Institute for Cooperation on Agriculture (IICA) has created a bioeconomy and production development program for the agricultural community in LAC, to support countries in designing strategies, as well as in formulating policies, investments and specific regulations to capitalize on the existing potential, in an inclusive and sustainable manner.

The program can provide support in generating evidence, in building awareness and capacities—research, studies, workshops and courses to develop capacities in this area for decision makers and actors of the agricultural and rural sectors—, as well as in formulating and implementing tools country and chain-specific roadmaps; designing and managing policy, regulatory and legal frameworks that enable new productive uses of the bioconomy and make them feasible; and in designing and implementing strategies, projects and strategic investments in value chains that foster new bioeconomy-related businesses. Additionally, the bioeconomy network will provide key contacts with strategic partners (such as PROMECAFÉ) to develop the coffee valie chain in the region.

The Regional Cooperative Program for the Technological Development and Modernization of Coffee Production (PROMECAFE) is a research and cooperation network comprised of coffee institutions from ten countries: Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Peru, the Dominican Republic and Jamaica, with support and coordination provided by IICA, CATIE and World Coffee Research (WCR).

The **Inter-American Institute for Cooperation on Agriculture (IICA)** is the specialized agricultural agency of the Inter-American System, with a mission to support the efforts of its Member States to achieve agricultural development and rural well-being. Established in 1942, the Institute promotes hemispheric cooperation with a view to developing a more competitive, inclusive and sustainable agriculture sector, which is capable of feeding the region and the world.

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